Section 5.3

Chester Ismay, Tom Linton

Ripon College, Central College

"There is no secret to success, but it's the result of hard work, good preparation and learning from failure."

- Ally Mbululo

Conserving Hotel Towels?

Many hotels have begun a conservation program that encourages guests to re-use towels rather than have them washed on a daily basis. A recent study examined whether one method of encouragement might work better than another. Different signs explaining the conservation program were placed in the bathrooms of the hotel rooms, with random assignment determining which rooms received which sign. One sign mentioned the importance of environmental protection, whereas another sign claimed that 75% of the hotel's guests choose to participate in the program. The researchers suspected that the latter sign, by appealing to a social norm, would produce a higher proportion of hotel guests who agree to re-use their towels. Researchers used the hotel staff (a mid–sized, mid–priced hotel in the Southwest that was part of a well-known national hotel chain) to record whether guests staying for multiple nights agreed to reuse their towel after the first night.

(1) What are the observational units?

A Guests at hotels

B Mid–sized mid–priced hotels

C Multi-night guests at hotels

D The two signs

E Towels

(2) What is the explanatory variable?

A If a guest stayed multiple nights.

B Which sign (social norm or environmental) was displayed.

C If the social norm sign produced more towel reuse than the environmental sign.

D Whether or not a guest chose to re–use their towels.

E None of the above.

The study results are summarized in the table below. Assume we abbreviate the social norm sign group using "sn" and the environmental sign group using "e".

	Social norm	Environmental	Total
Re-used Towel	98	74	172
Did Not Re-use	124	137	261
Total	222	211	433

We see that

- the statistic is _____

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	Social norm	Environmental	Total
Re-used Towel	98	74	172
Did Not Re-use	124	137	261
Total	222	211	433

We see that

- the statistic is $\hat{p}_{sn} - \hat{p}_e = 0.441 - 0.351 = 0.09$;

- the overall or combined proportion is $\dfrac{172}{433} \approx 0.397$.

(3) Would you guess that the difference in conditional proportions, $\hat{p}_{sn} - \hat{p}_e \approx 0.09$ is statistically significant?

A No, $p = 0.09$ does not give strong evidence against the null hypothesis.

B No, a 9% difference is small compared to 50%.

C No, but not for either reason above.

D Yes, the sample sizes are fairly large and the difference is relatively big.

E Yes, but not for the reason above.

(4) What is the most appropriate null hypothesis?

A $H_0 : \pi = 0.397$

B $H_0 : \hat{p}_{sn} - \hat{p}_e = 0$

C The social norm sign has a 50–50 chance of having a guest re–use their towel.

D The social norm sign increases the probability of towel re–use.

E None of the above.

(5) The correct alternative hypothesis could be stated as $H_a : \pi_{sn} - \pi_e > 0$. Which is the best description of the parameter π_{sn}?

A The long run probability that a guest with the social norm sign opts to re–use their towels.

B $\pi_{sn} = \frac{98}{222} \approx 0.441$.

C The population increase in the proportion of guests opting to re–use their towels with the social norm sign, as opposed to the environmental sign.

D The population proportion of guests who opt to re–use their towels.

E The probability that the social norm sign will increase the proportion of guests who opt to re–use their towels (over the environmental sign).

The image shows 500 simulated differences $(\hat{p}_{sn} - \hat{p}_e)$ assuming no association between the signs and guests opting for towel re–use. The study produced $\hat{p}_{sn} - \hat{p}_e \approx 0.09$.


Total Shuffles = 500

Mean = -0.001
SD = 0.045

Number of Shuffles

Shuffled Difference in proportions
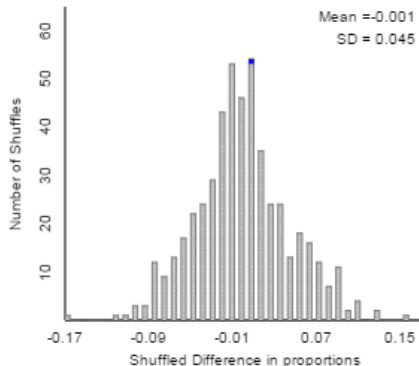
(6) What is the size of the p–value?

A It will be small, 0.09 is one SD away.

B It will be small, 0.09 is in the tail of the null distribution.

C It will not be small, the null distribution is centered near 0.

D It will not be small, 0.09 is large compared to zero.

E None of the above.

(7) What is true of the z statistic in this context?

A It is $\dfrac{-0.001 - 0.09}{0.045}$.

B It is $\dfrac{0.09 - (-0.001)}{0.045/\sqrt{433}}$.

C It measures the distance the statistic is from 0.5.

D Two of the above are true.

E None of the above.

Total Shuffles = 500

Mean = -0.001
SD = 0.045
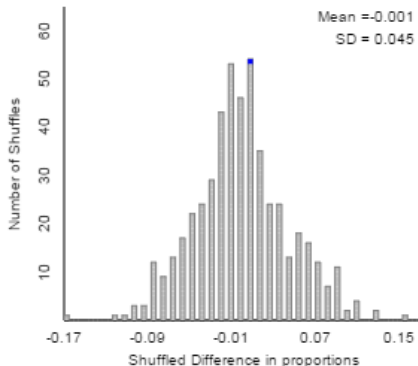
(8) What is true of the 2SD confidence interval for the parameter of interest?

A It is not centered at 0.

B It has a width of 0.09.

C We have strong evidence that the proportion of guests that re-used towels that were exposed to the social norm sign is larger than the proportion of those exposed to the environmental sign.

D All of the above are true.

E Exactly two of A-C are true.

Total Shuffles = 500

Mean = -0.001
SD = 0.045
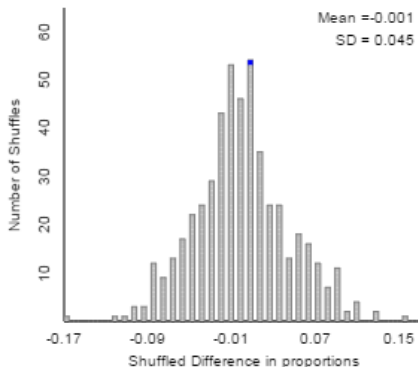
(9) Are the validity conditions met in this example to trust theory-based approaches?

A Yes, $\hat{p}_{sn}$ and $\hat{p}_e$ are far apart.

B Yes, n_{sn} and n_e are both larger than 20.

C No, $\hat{p}_{sn}$ and $\hat{p}_e$ do not equal 0.5.

D No, the response was not randomly assigned to the two levels of the explanatory variable.

E None of the above.

(10) Assuming that the validity conditions have been met, use the Theory-Based Inference applet to determine the p-value corresponding to the problem statement.

A 0.0269

B 0.091

C 0.501

D 0.9731

E None of the above.